DESIGN & FABRICATION OF SOLAR MOBILE REFRIGERATION PLATFORM (SUPPORT SYSTEM)

[1]Mr. K. SAINATH, [2]A.SOMA SHEKAR, [3]BANOTH PRABHAKAR, [4]I SAI CHANDU [5]Dr. SURESH AKELLA,

[1]Associate Prof., [2]M.Tech. Student, [3]M.Tech. Student, [4]M.Tech. Student, [5]Prof.in MED & Principal in SIET,

Department of CAD/CAM, Sreyas Institute of Engineering & Technology, Hyderabad
Department of Mechanical Engineering, Sreyas Institute of Engineering & Technology, Hyderabad.

Abstract: **-** We know that Refrigeration is an important part of human life to make it comfortable and easy. But refrigeration's inter depends upon electricity requirement it is difficult to access the refrigeration in many parts of the world. On the contrary Solar energy is reached to every part of the world and once set its most efficient renewable energy and also cheap to maintain and operate. The Fusion of Refrigeration and Solar energy makes up the most efficient way to operate the refrigeration. By giving the Refrigeration Wheels for transport it can also be travelled to remote places and also can be carried when the Refrigeration is most required but cannot be accessed. **It is most required the load distribution on the solar refrigeration system on the frame, platform (support system).**

***KEY WORDS*: -** Compressor, Condenser, Evaporators, Expansion Valve, Discharging, Power Inverter, Battery, Arc welding.

I. INTRODUCTION

A refrigerator (colloquially fridge) consists of a thermally insulated compartment and a heat pump (mechanical, electronic or chemical) that transfers heat from the inside of the fridge to its external environment so that the inside of the fridge is cooled to a temperature below the ambient temperature of the room. Refrigeration is an essential food storage technique in developed countries. The lower temperature lowers the reproduction rate of bacteria, so the refrigerator reduces the rate of spoilage. A refrigerator maintains a temperature a few degrees above the freezing point of water. The Optimum temperature range for perishable food storage is 3 to 5 °C (37 to 41 °F). A similar device that maintains a temperature below the freezing point of water is called a freezer. The refrigerator replaced the icebox, which had been a common household appliance for almost a century and .a half.

II. LITERATURE SURVEY

Comparison of experimental and theoretical values of heat transfer rate, Coefficient of performance of water cooler and spilt AC by using a single compressor and rejected heat is used in geyser application. [1]

The aerospace applications are bonded to the low weight and high structural strength necessity, this leads to more research work in the field of composites. The composites hold more strength to weight ratio compared to the other conventional materials. Their strength mainly depends on the orientation of the reinforcement material and volume fraction of matrix and reinforcement. The sandwich composites are extensively used in aerospace applications where a conventional material's strength is increased by adding the layers of the composite material by prescribed orientations. [2]

Additive Manufacturing (AM) or 3D Printing has become very popular in industry and academia for prototyping or small scale production. It is very important to understand the mechanical properties of products manufactured through various additive manufacturing processes like Stereo lithography (SLA), Selective Laser Sintering (SLS), and Fused Deposition Modelling (FDM) and Poly jet. In this project, we propose to evaluate mechanical properties such as Dimensional Accuracy, Tensile property and Shore Hardness of components manufactured by various additive manufacturing techniques as per ASTM D638-10 type IV standard. [3]

Air-Conditioning cum Water dispenser system is a unique combination of air-cycle and water-cycle into a single unit. This system may consist of a compressor, condenser, evaporator, expansion valve, solenoid valve, reversing valve, copper tubes, heating, and cooling thermostats. Here we used a single compressor to compress the air cycle and water cycle. [4]

III History of Refrigerant

Commercial refrigerator and domestic refrigerators uses gases such as ammonia (R-717) or sulphur dioxide (R-764), which occasionally leaked, making them unsafe for home use. In 1930s, a non-flammable refrigerant such as Freon-12(R-12) were introduced but however the R-12 causes damages to the ozone layer which makes the USA government to issue a ban on its use in new refrigerators and air conditioning system in 1994. In 1990, a less harmful refrigerant R-134a (tetrafluoroethene) was use for perfect replacement to R-12 in 1990, but still found in many old systems.

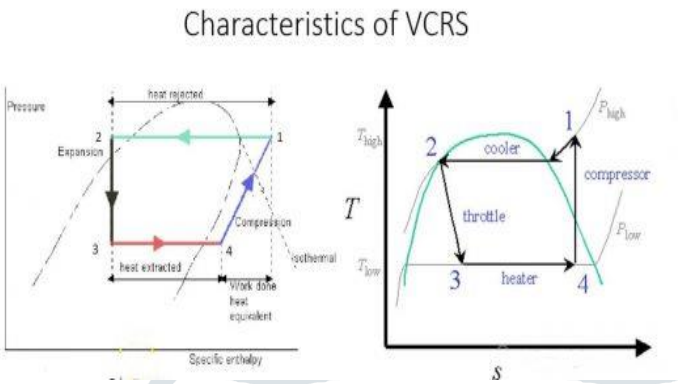


Fig: 1 P-V and T-S Diagrams of VCRS

III. COMPONENTS OF REFRIGERATOR

1. COMPRESSOR

Rotary compressors are 'high-pressure shell' type compressors. The suction on these compressors is taken directly into the compression chamber. Gas compressed in the compression chamber is discharged into the compressor casing. It should be noted that from a cold start-up, high-pressure shell-type compressors take longer to reach their normal operating pressure in the compressor shell. This is partly due to the larger volume of the compressor casing and partly as a result of refrigerant being trapped in the oil. Any refrigerant in the oil has to completely evaporate before condensing pressure can reach its operating level.

2. EVAPORATORS

Evaporators are one of the main reasons why refrigeration, and therefore air conditioning, became practical for use in both home and industrial cooling. Simply put, an evaporator allows a contained pressurized liquid to turn into a gas. Evaporators allow a contained pressurized liquid into gas.

3. CONDENSER

A system that involves heat transfer uses a device called condenser. A condenser is a device or unit used to condense a substance from its gaseous to its liquid state, by cooling it. In doing so, the latent heat is given up by the substance and will transfer to the condenser coolant. Condensers can be made according to numerous designs, and come in many sizes ranging from rather small to very large. For example, a refrigerator uses a condenser to get rid of heat extracted from the interior of the unit to the outside air. Condensers are used in air conditioning, industrial chemical processes such as distillation, steam power-plan, and other heat-exchange systems. The use of cooling water or surrounding air as the coolant is common in many condensers. Analysis of Roll bond evaporator.

4. EXPANSION VALVE

The purpose of the expansion valve is to rapidly reduce the pressure of the refrigerant in the refrigeration cycle. This allows the refrigerant to rapidly cool before entering the evaporator.

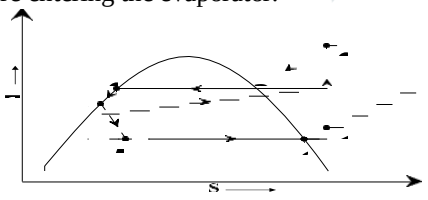


Fig 2 graphical representation of condenser

5. SOLAR ENERGY

Solar energy is the energy that is radiated from the sun. In the sun's core nuclear fusion takes place, this releases energy, which is in the form of electromagnetic waves reaches the surface. This light and heat from the sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants, and artificial photosynthesis. The large magnitude of solar energy available makes it a highly appealing source of electricity. The United Nations Development Programme in its 2000 world's energy assessment found that the annual potential of solar Energy was 1,575 – 49,837 exajoules (EJ). This several times larger than the world energy consumption, which was 559.8 EJ in 2012.

Compressor

The compressor is the core of every refrigeration circuit. It brings vapour refrigerant from low pressure to high pressure there are compressors in different compression principles. There are compressors for example stroll compressor, screw compressor, rotary compressors, turbo compressors and reciprocating compressors. This compressor is hermetic type compressor.

Hermetic reciprocating compressors are different from structurally related types like the semi-hermetic (motor and compression mechanics form a unit) and open reciprocating compressors (motor separate from the compression mechanics) in that they have a sealed design.

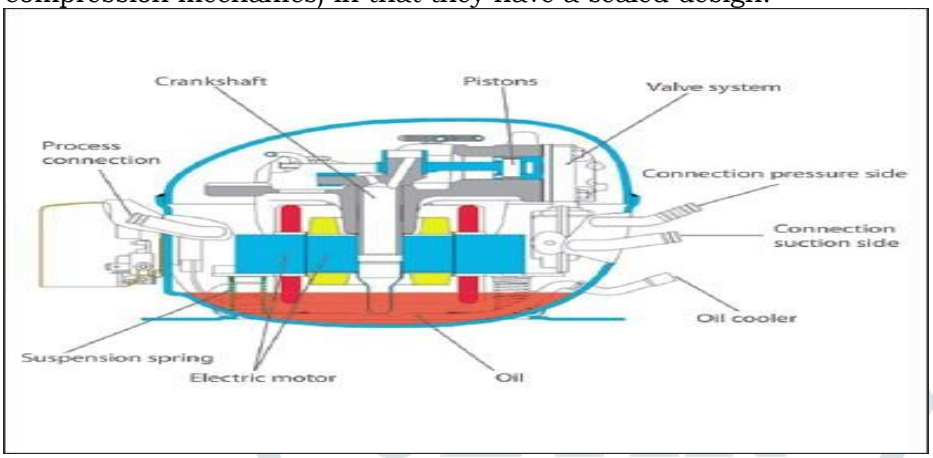


Fig 3 a pictographic representation of the photovoltaic effect

SPECIFICATION OF SOLAR PANELS

1 panel of 40 watts

Open circuit voltage = 22 volts

Maximum power voltage= 19.25 V

Closed-circuit current = 1.11 amps

Dimensions = **1 panel of 20 watts**
Open circuit voltage= 22 volts
Maximum power voltage= 19.8 V

Closed-circuit current= 2.8 amps

Dimensions =

BATTERY

The battery we used is a lead-acid battery that produces electricity form the lead electrode as positive and Lead-oxide electrode as negative and the potential difference between the two electrodes produces electricity.

Working of solar cell or PV cell

Solar cell are made up of silicon. Which, by itself does not conduct electricity. So, it is doped with phosphorous on the top, which has excessive electrons, and boron below which has deficient electrons. This creates a junction or a potential. The potential barrier is broken when the photon form the sun hits the solar cell. The photon excites the electrons and barrier is breached and this allows the current to flow. For example photo voltaic effect is seen in photo diodes. When sunlight or other sufficiently energetic light is incident upon the photodiode, the electrons present in the valence band absorb energy and being excited, jump to the conduction band and become free. These excited electrons diffuse, and some reach the rectifying junction where they are accelerated into a different material by a built-in potential.

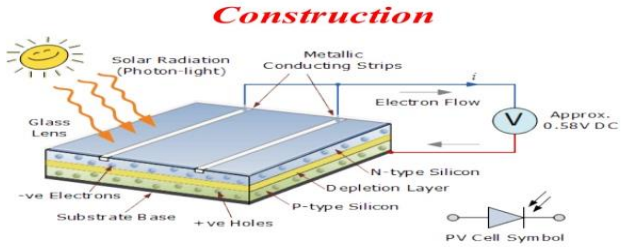


Fig 4 pictographic representation of current flow in the PV cell

Movement of the sun

The sun position with respect to an observer on earth can be fully described by means Of two astronomical angles, the solar altitude and the solar azimuth. The solar azimuth angle is the azimuth angle not the sun's position. This horizontal coordinate defines the sun's Relative direction along the local horizon, whereas the solar zenith angle defines the suns apparent altitude. Solar azimuth defined as the angle between a line due south and the Shadow cast by a vertical rod on earth. This convention states the angle is positive if the line is east of south and negative if it is west of south. The zenith angle is the angle between the sun and the vertical. The zenith angle is Similar to the elevation angle but it is measured from the vertical rather than from the Horizontal, thus making the zenith angle = 90 degrees elevation.

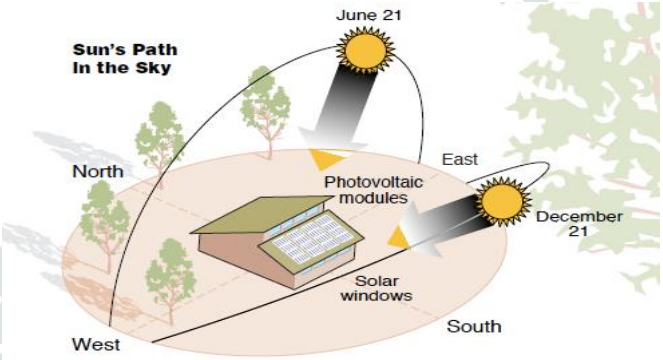


Fig 5 Movement of the sun

Arc Welding

Arc welding is a welding process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals when cool result in a binding of the metals. It is a type of welding that uses a welding power supply to create an electric arc between electrode and the base material to melt the metals at the point of contact. Arc welders can use either DC or AC current and consumable or non-consumables electrodes.

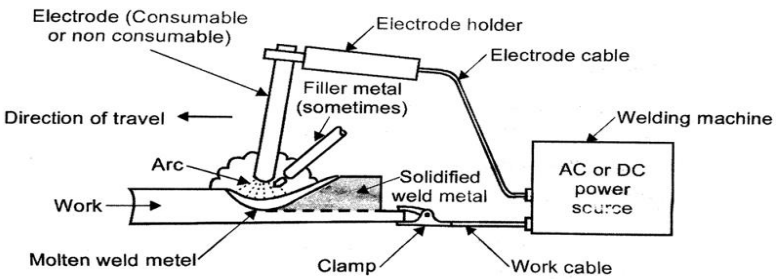


Fig 6 Arc welding circuit diagram

Discharging

Connection of an electrical load allows electrons to flow from negative to positive terminals. This reduces the charge and the voltages at the electrodes. The chemical reactions are able to proceed, generating new electrons and generating the power that is converted to electrical form to drive the external electrical load. As the battery is discharged, the electrodes become coated with lead sulfate and the acid electrolyte becomes weaker.

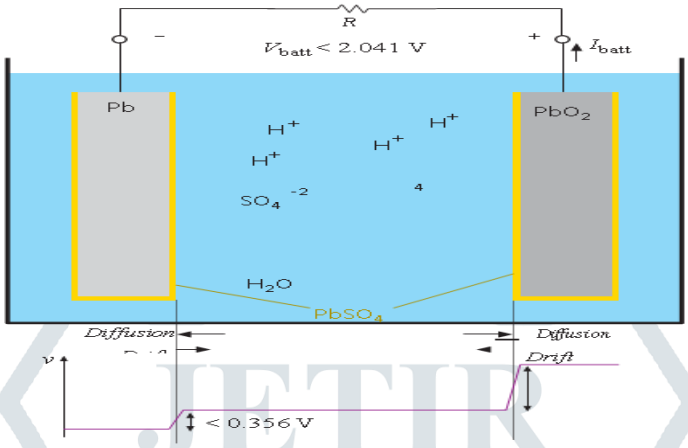
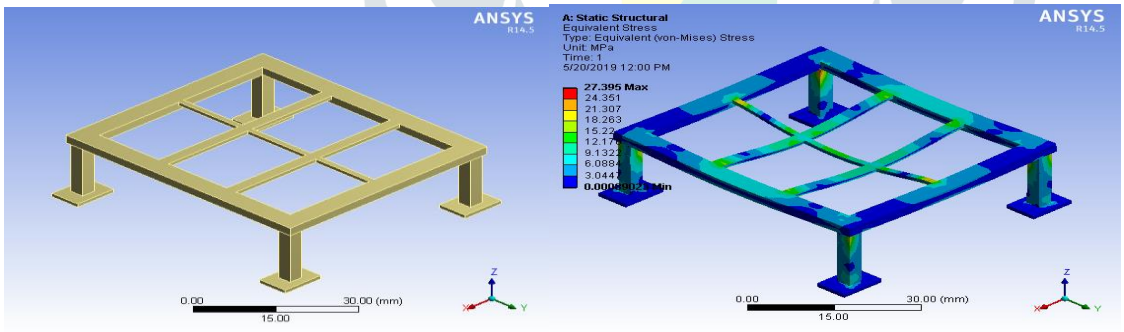


Fig 7 pictographic representation of Discharging

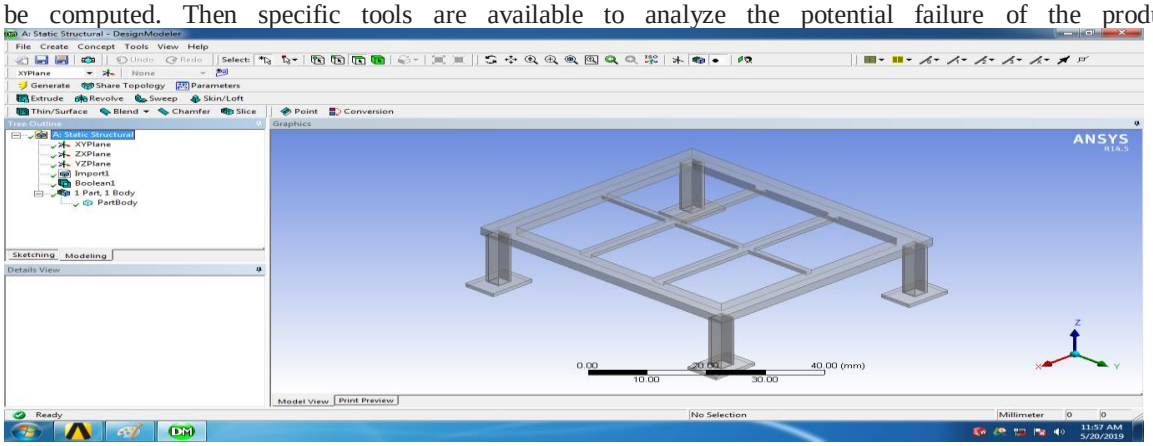
DESIGN OF ANALYSIS

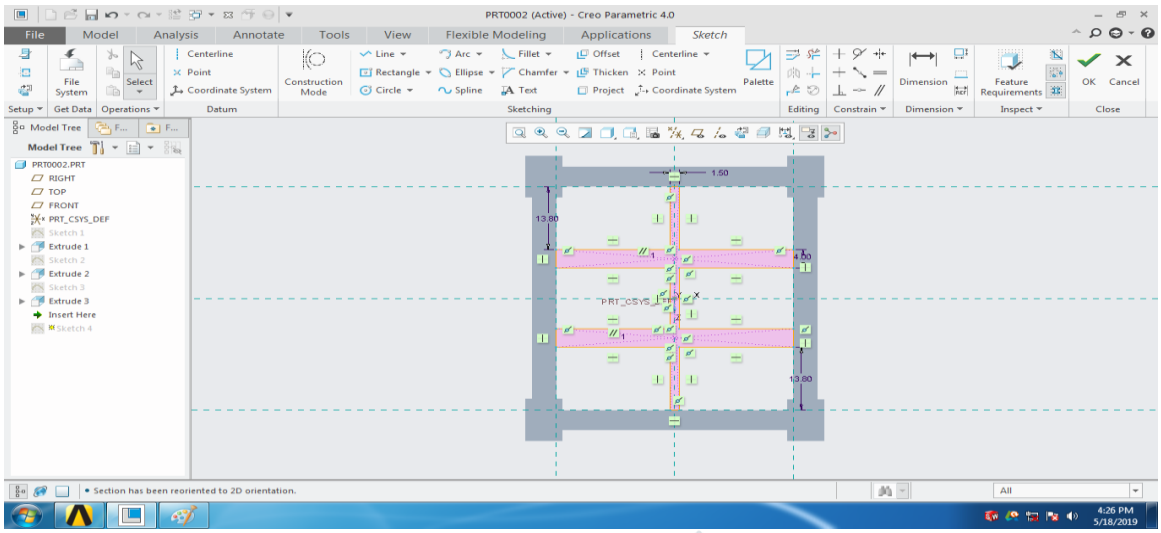
Analysis of roll band evaporator ANSYS provides a complete simulation workflow for the design of composite structures. This process is very similar to the manufacturing process:

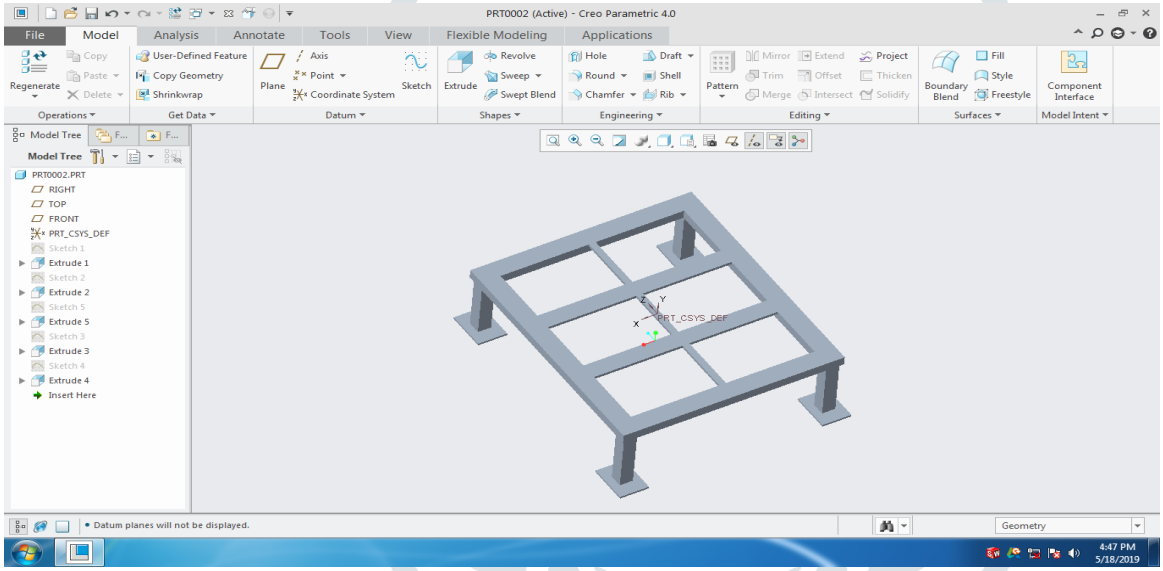
- Definition of base materials, fabrics and predefined stackups [layups]
- Intuitive definition of material orientation based on geometric attributes
- Global and local ply definition as when fabrics are laid onto a mold



Once the model has been setup, loads and boundary conditions are defined on the geometry and composite failure solutions can be computed. Then specific tools are available to analyze the potential failure of the product being designed:

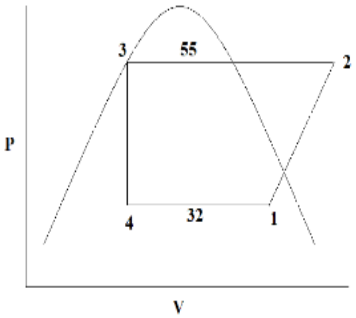






Calculations

Power Consumed



For 1KJ of energy the power required is 0.27w
i.e., for 132KJ of energy
176.4KJ = 49w/h
The Battery like to use is a 12v 17ah battery.

Power produced by this battery is 204 w.

Time required for complete drain of the battery.

Time = 204w

49w

= 3.5hrs

Solar

The solar panel we like to use is a 60w DC panel.

1hr of this panel will produce 60w, time required for charging. 1hr = 60w

?hr = 204w

1/x = 60/204

X = 4hrs

REFERENCES

[1] **Experimental and Theoretical Analysis of Integrated AC with water cooler**
DSA Sainath kasuba, Sandeep Enakoti, Dr T K K Reddy
International Journal of Scientific Research & Review 7 (7), 7-16

[2] **Sandwich Composite for UAV Wing Design and Fabrication**
K.Sainath, Syed Ibadaddin , D.V. Paleshwar
International Journal of Research in Engineering, Science and Management 1 …

[3] **Experimental Evalution of Mechanical Properties of Stereolithography , Selective laser Sintering ,Fused Deposition modeling and Other Additive Manufacturing Methods**
K.sainath, K.Shilpa ,D.V.Paleshwar
IJRESM 1 (10), 289-293

[4] **Experimental and Theoretical Analysis of Integrated AC with Water Cooler**
Dr.SA ,kasuba Sainath , Sandeep Enakoti,Dr.TKK Reddy
International Journal of Scientific Research and Review 7 (7)

[5] **Optimization of capillary tube dimensions using different refrigerants for 1.5 ton mobile air conditioner**
K Sainath, TKK Reddy, S Akella
Case Studies in Thermal Engineering

[6] **Body design and Fabrication of Portable Horizontal Air Conditioner**
sainath kasuba
International journal for general Science and engineering 5 (8), 64-68

[7] **Fabrication of mobile AC for spot cooling.**
BN Sainath kasuba
International journal for general Science and engineering 5 (8), 69-72

[8] **Composite material analysis of front axle of a heavy vehicle using materials glass carbon composite & s-2 glass epoxy**
Sainath kasuba ,D. Gangadhar
International Journal of General Science and Engineering 5 (7), 23-27

[9] ANALYSIS PROTABLE AC WITH COOLING CHAMBER
I SAICHANDU JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (1)

[10] DESIGN AND FABRICATION PROTABLE AC WITH COOLING CHAMBER I SAICHANDU IJSART JOURNAL

[11] **Display water cooler**
sainath kasuba, k.sai kiran, B,Nikhil kumar, A.veneeth,
Sreyas International journal of Scientists and technocrats 1 (2), 6-13

[12] **Experimental and Theoretical Analysis of Roll Bond Evaporator as Air Conditioner'**
Mr. Kasuba Sainath , Dr.T. Kishen Kumar Reddy, Dr.Suresh Akella
International Journal of Advanced Research in Computer Science and Software …

[13] **DESIGN OF MOBILE AIR CONDITIONING SYSTEM'**
Mr. Kasuba Sainath , Dr.T. Kishen Kumar Reddy, Dr.Suresh Akella
(ICETiME

[14] **Estimation of Refrigeration side Heat transfer coefficient of Zero Ozone Depletion Refrigerant R134a used in Mobile AC in comparison with R22 Refrigerant**
K Sainath, PS Ravi, R Saini, S ANella